Discussion on "Controls - Overview" by Jean Delayen

Delayen gave on overview on controls for systems like CEBAF and SNS (elliptical cavities at 2K). While these machines have well defined operational parameters, a multi-species and multi-target machine like RIA has a much wider range of scenarios that need to be provided and controlled. Shepard pointed out that a tuning accuracy of 2*tuner sensitivity + 6*microphonics bandwidth is not applicable for RIA. They aim at 2*tuner sensitivity + 20*microphonics bandwidth. Their main concern is strongly deviating behavior of components, not the behavior of the average machine.

Shepard also mentioned that the existing experience with microphonics behavior is not applicable for RIA: RIA is a machine with "soft" bulk niobium structures operated at 4K, using forced flow in the cryo-system. CEBAF experience does not apply due to the 2K operation, Legnaro's successful microphonics control work does not apply due to their much stiffer niobium on copper structures.

There was general agreement that the main issue to understand the microphonics issues of a system is the understanding of the interaction between the cryosystem and the RF-structures.

As a next point the different valuation of microphonics for different projects was expressed. A system like CEBAF can tolerate the loss of lock for a cavity once in a while. The tolerances need to be much tighter for RIA that cannot afford to loose lock at all (on a timescale of a few milliseconds). Availability requirements for all these machines are driven by the tolerable thermal fluctuation in the beam targets. Delayen expressed that the target requirements for any machine need to be well understood upfront, for both being to conservative in tuning control, or being to aggressive can be costly.

Pagani made a general comment the microphonics issues of a system are driven by boundary conditions. The same object (e.g. resonator) can be working in one environment and not at all in a different one. Boundary conditions like helium temperature can change the response completely. His conclusion is that each setup of cavities, external components, cryosystem, ... needs to be studied separately. He also claimed that elliptical cavities are more easily controlled, as there is a simple way to control frequency and phase of the RF-input. Delayen expressed that he does not see any advantage of the ellipticals, as all microphonics responses of a system are driven by mechanical waves that have the same time delay issues to influence a full structure.

Delayen reported that Jlab is looking at a novel way to control cavity tuning by ferrite in the waveguides feeding power couplers. They see the potential for a fast active control of microphonics to reduce the control margin needed for cavity operation e.g. for SNS. It was agreed that could be an important contribution to the field.

Pagani summarized the problematics of microphonics. At the origin of microphonics are mechanical phenomena. The effect that needs to be dealt with is, is the behavior of the RF in the cavities. The transfer mechanism is complex. It affects both the behavior of the fundamental as the higher order modes. Since even identical resonators do not have an identical RF-behavior over all modes, the responses show the wide spread reported here.